# TOBCAT project results: applying object categorization techniques in real-life industrial cases

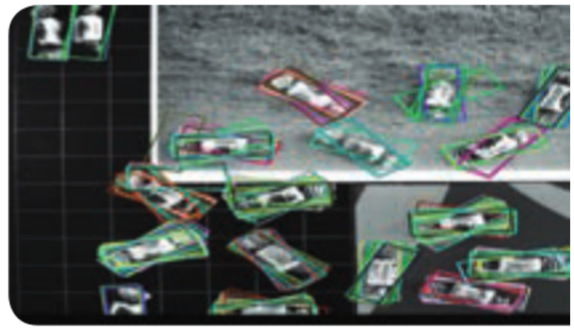
KU LEUVEN

In this IWT-TETRA we investigated the use of object categorization techniques for application in real-life industrial cases. With these advanced computer vision algorithms, objects can be detected in camera images regardless of intra-class variances in shape, colour, orientation, size, etc. A detector for these difficult objects is trained on a large number of annotated training images describing the object class. We successfully built detectors for orchids, pedestrians, biscuits, elderly walking aids, candy, mites, wheat grains, road markings and cars.

During this project we translated the Viola&Jones object detection framework, known from the face detector in consumer digital cameras, to a ready-to-use software package for the industrial partners to create their own object class detection model and interface. Besides that, we looked into existing object classification software that was available in the open source computer vision library OpenCV, which contained an implementation of the HOG+SVM and LatentSVM based algorithms.

We discovered that there is a large interest in these techniques from our industrial partners. A first case focussed on classifying a large set of phalaenopsis flowers into different categories. We used a reduced set of training data to train a flower model detector that could detect all categories at once. Afterwards each detection is submitted through a set of binary SVM classifiers to derive which actual orchid category it is: uniformly coloured or with a pattern (striped, dotted, spotted or lip).

In a second case we enhanced the Viola&Jones framework with rotation invariance. We noticed that the original object class models were only robust to slight orientation changes (5°-10°) as compared to the training data. However, many industrial applications have objects appearing in front of the camera in almost every possible orientation. Therefore we studied a case on rotation invariant candy detecting for industrial bin picking. Before performing the object detection we create a 3D rotated image space, by rotating the original input 36 times over 10 degrees. By performing the detection on each layer of this space we are able to detect in object in every single orientation.



Another downside of these state-of-the-art object categorization techniques is that they need tons of training data to achieve a robust object model. However, our tests illustrated that knowing the context of the application, and deciding which parameters can be reduced in range, allows to train effective and robust models with only a couple of hundreds of training images. For example using the fact that a camera setup is mostly fixed in industrial cases, we ensure that an object has a limited size range in which it can appear and that we have a good knowledge about the background. This reduces the amount of background images for training needed and increases the detection time because we do not look for object that are out of the scale range.

Finally, all the results and conclusions that were made during this IWT-TETRA project will be presented at our AAAVision Symposium, which is hosted at campus De Nayer in Sint-Katelijne-Waver on thursday, the 18th of september. Besides other project results, a demo fair will be held where industrial and academic researchers demonstrate applications of complex computer vision techniques. ■

EAVISE

Embedded & Artificially Intelligent VISion Engineering

AAA Vision